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DESICCATING BARRIERS
FOR MILITARY PACKAGING

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Technical Report No. 1

Covering the Period
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ABSTRACT

This report covers work performed under the first period of the contract.

The aim of this study is to develop new and superior packaging systems and materials capable of producing a dehumidified or moisture-controlled atmosphere, similar to that presently produced by Method II of Specification MIL-P-116D, at a lower cost and with a greater degree of efficiency.

The work to date has consisted mainly of an attempt to correlate the results of research of the literature with research in the laboratory, and preliminary laboratory investigations of the more promising avenues of development.

The work is continuing in line with results to date.

Introduction - Heretofore, the process of deterioration due to moisture has been largely controlled by Method II of Specification MIL-P-116 which provides for a highly impervious barrier used in conjunction with a fairly active desiccating agent. In simplest terms, the credo can be fairly stated as (a) 'Keep the water out' and (b) 'Absorb the water if it gets in'. Approximately 20 years of experience, with various types of military hardware, indicates that this approach is effective, though somewhat costly and inefficient. The aim of this study is to find simpler and more efficient methods, at lower cost, with due regard for the technological advances which the last two decades have brought.

The basic approach we have used, stated in the simplest terms, might be the alternative credo (a) 'Keep the water out, if possible' and (b) Absorb it before it gets inside the package'; and (c) Gain as many additional advantages as possible.

In following this approach, it has been necessary to re-evaluate many of the generally accepted concepts of packaging procedure. Practicality has remained a major consideration, however, since practical end-use is the aim of any development program. Many different factors, from raw material costs to rate of obsolescence, have deserved attention. An attempt has been made to put all of these factors into a proper frame of reference, with due regard for the weight of each.

Design Targets - The following are the principal design objectives for the new type of barrier under development:

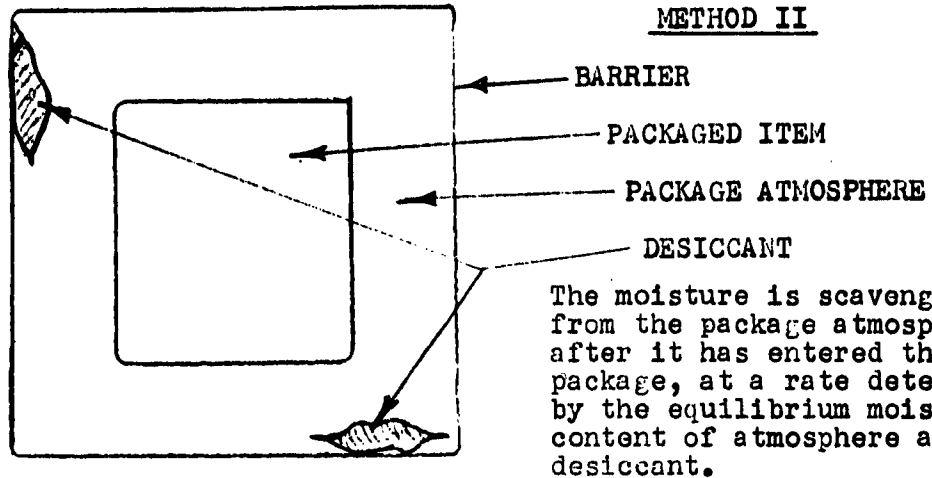
1. Highly water vapor resistant after flexing at 130 F. and minus 20 F.
2. Optically clear to such an extent that parts in an envelope will be readily visible.
3. Stable, durable, non-blocking and heat sealable.
4. Resistant to oils, greases and hydraulic fluids.
5. Offering a high degree of corrosion protection.
6. Relatively low in cost by comparison with Method II of specification MIL-P-116D.

Comment - To some extent, all the above are relative, not only to absolute standards but to one another. What is sought is the most effective and practical combinations of all the above qualities, keeping in mind the end-product objective in comprehensive terms.

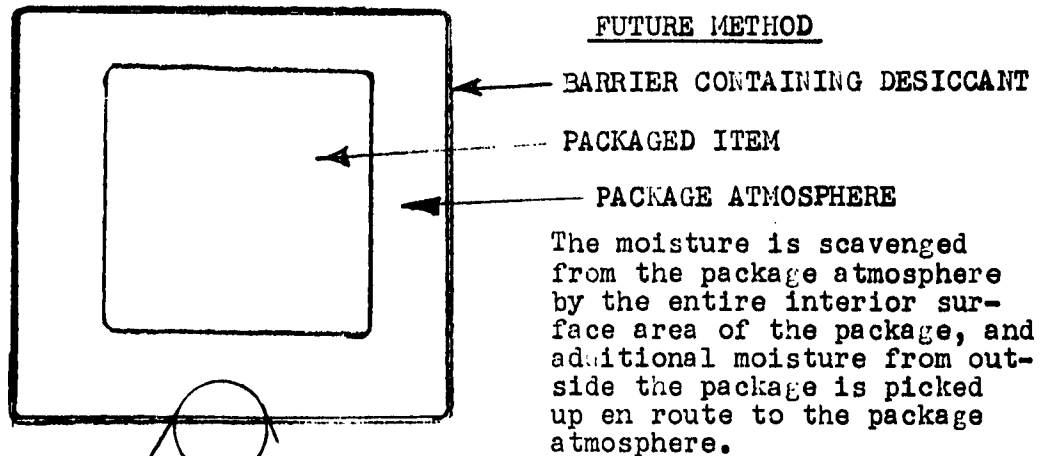
Preliminary investigations - It is advisable, and probably necessary, to start with a few basic concepts of the potential end product, and to compare it with present products. On the following page are diagrams of the two methods; their basic characteristics are listed below:

<u>Present Method II</u>	<u>Future Method</u>
Vapor resistant barrier, opaque in character.	Vapor resistant barrier, essentially transparent.
Moisture scavenger inside package.	Moisture scavenger within barrier.
Packaged item, dependent upon <u>remedial</u> desiccation	Packaged item, protected by <u>preventive</u> desiccation.

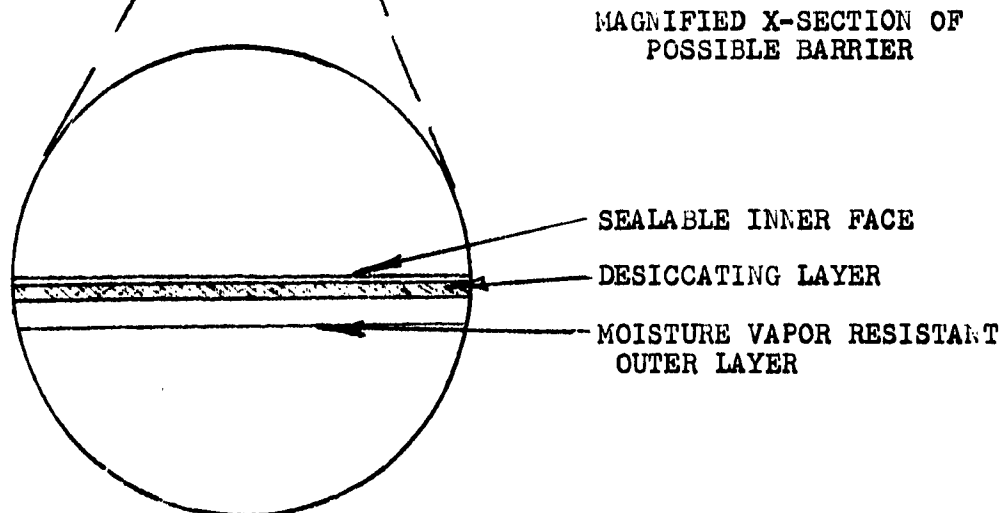
METHOD II



FUTURE METHOD



MAGNIFIED X-SECTION OF POSSIBLE BARRIER



Research of Literature - Since most prior research has been directed toward air conditioning and similar dynamic flow systems, rather than the relatively static conditions of packaging, literature research yielded more clues than facts. On this basis, we re-examined some of the more promising materials which might be suitable for the end-uses now contemplated. The following seemed the most likely prospects as liquid desiccants and dissolving solids;

Calcium chloride

Lithium chloride

Diethylene glycol

Because of their toxic or corrosive natures, the following industrial desiccants seemed inappropriate;

Sulfuric acid

Phosphoric acid

Sodium hydroxide, etc.

For the time being, largely because we cannot envision practical end uses, we have neglected solid desiccants such as silica gel, activated alumina, calcium sulfate, activated carbon and the like.

Preliminary experimentation with the desiccants selected is proceeding along a variety of avenues of approach, as results become available.

Preliminary results

To meet the design targets set up, we have considered first several common plastics which would provide the necessary transparency, stability, sealability, oil resistance, flexibility and relatively low cost. Polyethylene, vinyls, Saran and Mylar appear to be the most likely prospects for a starting point, alone or in combinations.

For the desiccating materials, Calcium chloride, lithium chloride, diethylene glycol and glycerin, alone or in combinations, are among our first considerations.

Comparative methods - For the time being, the experimental work is using direct comparison between the prospective future combinations and present specification materials. The Method II pack is being compared directly and simultaneously with the possible future combinations.

Costs - Costs are being compared similarly. The following price and quantity comments have been received from manufacturers: "For most barriers, 1,000,000 square feet is an economical run. Annual open-end contracts to a single supplier may go as high as 10,000,000 square feet. Prices start at about 7¢ per sq. ft. and drop to about 5½¢, depending on quantity, with desiccant prices (on a sq.ft. of barrier basis) starting at about 3¢ and dropping to about 2½¢ or 2¼¢."

On the basis of these figures, it becomes evident that each penny per sq. ft. on an annual contract of 10,000,000 ft. represents a saving of 100,000 dollars.

With this firmly in mind, we are pursuing the work.